The impact of user-perceived e-procurement quality on system and contract compliance

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Abstract

Purpose – Whilst e-procurement has significant potential to reduce the purchasing costs of an organisation, the realisation of these savings requires user compliance. In this paper we examine the extent to which user-perceived e-procurement quality (operationalised through the dimensions of *professionalism*, *processing*, *training*, *specification*, *content*, and *usability*) influences both system and contract compliance.

Design/methodology/approach – User perceptions of e-procurement quality were examined in four UK organisations using survey data from 274 respondents.

Findings – We find strong evidence of a positive relationship between user-perceived e-procurement quality and both system and contract compliance. System compliance was most strongly influenced by *professionalism* and *content* dimensions, whilst contract compliance was most strongly influenced by *processing*, *specification* and *content* dimensions.

Research limitations – Data were collected from e-procurement users in four organisations, which may limit the extent to which findings can be generalised.

Practical implications – User perceptions of e-procurement provision significantly influence system and contract adoption. Practitioners should pay attention to management of different dimensions of perceived quality as they may have different effects on both contract and system compliance.

Originality/value of the paper – This study is the first to empirically assess the relationship between user-perceived e-procurement quality and compliance. Our findings challenge the assumption that the monopolistic dynamics common within internal services, such as e-procurement provision, are sufficient to ensure compliance. Dissatisfied individuals invariably find ways to circumvent mandatory systems and contracts.

Key words – E-procurement, user-perceived e-procurement quality, system compliance, contract compliance, maverick buying, internal service, technology adoption, information systems

Paper type – Research paper

Introduction

The advent of e-procurement creates significant potential for reduced purchasing costs in relation to transaction costs and the price paid for goods and services. However, the realisation of these savings requires the compliance of users towards both systems and contracts (Croom and Johnston, 2003). Kulp *et al.* (2006) present a three-phase process for addressing problems of non-compliance: (1) gathering data; (2) identifying causes of non-compliance; and, (3) designing control systems to ensure compliance. In this paper, we are concerned with identifying the causes of non-compliance. Building on previous literature (Harink, 2003; Croom and Johnson, 2003; Reunis *et al.* 2004; Croom and Brandon-Jones, 2007), we argue that how the user (as an internal customer) perceives the quality of e-procurement provision is important in influencing levels of system and contract use. In situations where the provision of e-procurement fails to meet expectations, individuals may find ways to circumvent official procurement processes. However, to date, there has been no empirical assessment of the relationship between user-perceived e-procurement quality and compliance.

We define user-perceived e-procurement quality as an individual user's perception of the quality of an e-procurement system and the support provided to use it. The term 'user' refers to individuals who can log onto an e-procurement system and place an order, authorise, receipt, make payment, or run reports. Usually, the procurement function will act as the service provider to these users. In this study, we use survey data to empirically examine the relationship between user-perceived e-procurement quality (operationalised through six dimensions: *professionalism; processing; training; specification; content;* and, *usability)* and the level of system and contract compliance.

The paper is structured as follows. Firstly we define e-procurement and discuss how its potential to deliver cost savings is strongly influenced by the level of maverick buying, operationalised as system and contract non-compliance. We then examine the concept of user-perceived e-procurement quality and develop hypotheses which link user-perceived e-procurement quality to both system and contract compliance. After discussing our findings and outlining the implications for academics and practitioners, we draw conclusions and suggest opportunities for further research.

Theoretical Support

E-procurement and Non-Compliance

E-procurement can be used to describe various forms of communication technology at different stages of procurement (Harink, 2003). This may include need identification, specification, search, sourcing, negotiation, order placement, receipt registration, payment, and post-supply evaluation. In this study, we were particularly interested in the inter-organisational systems that automate the ordering process and link end-users to the electronic catalogues of preferred suppliers. These systems enable ordering, receipting, and payment responsibilities to be decentralised to individuals who actually use the goods and services. As such, the definition of e-procurement adopted here is relatively focused and relates closely to the terms *E-MRO, Web-based ERP,* and *E-Informing* (de Boer *et al.* 2002).

Purchasing literature has emphasised the potential contribution of e-procurement in lowering transaction costs and the prices paid for goods and services (Croom, 2000; Zsidisin and Ellram, 2001; Mishra *et al.* 2007). However, many organisations report disappointing results from e-procurement implementation, largely as a result of non-compliance by end-users (Aberdeen Group, 2001). Arbin (2003) argues that if the potential value of e-procurement is to be achieved, user adoption is crucial. This view receives support from a number of studies reporting a positive relationship between compliance and the financial benefits of e-procurement (Croom and Johnston, 2003; Reunis and van Raaij, 2006; Karjalainen *et al.*, 2009).

The concept of e-procurement non-compliance builds on the broader notion of maverick buying. Maverick buying is defined as buying outside established procedures or contracts that do not optimise value for money (Cox *et al.* 2005). Within an e-procurement context, we understand non-compliance as the failure of individuals to comply with an e-procurement system when placing orders or the failure to use mandated contracts. As such, the term incorporates two key elements - *system compliance* and *contract compliance*.

System compliance is defined as the extent to which individuals use an e-procurement system to purchase goods and services (Croom and Brandon-Jones, 2005). System compliance can help reduce transaction costs, by enabling a higher level of accuracy in requisition, invoicing and payment, through electronic documentation and process automation (Barnes *et al.* 2002). By comparison, orders placed outside of an e-procurement system are liable to transmission errors and require additional resources during invoice and payment (Croom, 2000). Users can avoid using a system to place their orders in a variety of ways, including the use of petty cash, paper-based orders or

making direct contact with suppliers by telephone. Collections made from suppliers and then retrospectively ordered and receipted through the e-procurement system also represent system non-compliance.

In this study, contract compliance is defined as the extent to which individuals comply with mandated contracts (Lonsdale and Watson, 2005; Angeles and Nath, 2007) and is desirable for a number of reasons. Firstly, transaction, invoicing, payment, and supplier management costs tend to be reduced (Karjalainen *et al.* 2009). Secondly, aggregation of requirements often make contact procurement less expensive (Turban *et al.* 2000; Croom, 2000). Finally, risk may be reduced as terms and conditions are more carefully scrutinised for contracted procurement (Karjalainen *et al.* 2009). An individual who places an order via an e-procurement system, but with an off-contract supplier can be termed contract non-compliant. In contrast, a user who orders from an approved contract supplier, but places their order manually is contract compliant, but system non-compliant.

Increased attention has been paid to how the implementation of e-procurement systems can help increase control over the procurement process within organisations (Neef, 2001; Croom and Johnston, 2003). In some studies, e-procurement has been credited with increased transparency across functions which may subsequently improve the extent to which individuals use the system and comply with contracts (Subranium and Shaw, 2004; Cugnasen and Lee, 2006). Michaelidis *et al.* (2003) suggest that the migration from traditional procurement processes to e-procurement is one of the most effective ways to improve compliance amongst users.

However, other studies postulate that simply implementing e-procurement does not, in itself, guarantee increased compliance. Specifically, it is argued that user perceptions of e-procurement provision may influence levels of system and contract compliance, and deserves further exploration (Marshall *et al.* 1998; Croom and Johnston, 2003; Reunis *et al.* 2004). For example, Croom and Johnston (2003) argue that even when use is mandated, individuals may find ways to circumvent official purchase processes if they are dissatisfied with e-procurement provision. To better understand the nature of compliance in organisations, we focus on how user perceptions impact the adoption of mandated e-procurement systems and contracts.

User-perceived e-procurement quality (EPQ)

User-perceived e-procurement quality is a multi-dimensional construct incorporating user perceptions of an e-procurement system and the support provided to use it. As such, it draws on a range of complementary contexts, including information systems and internal service provision (Brandon-Jones, 2006, 2008). The dominant focus of early information systems' provision is on the quality of product attributes, including timeliness, accuracy, and format (Jenkins and Ricketts, 1979; Larcker and Lessig, 1980). However, these attributes are considered in isolation of how the user perceives them. In response to the increased adoption of end-user computers, Doll and Torkzadeh (1988) developed an end-user computing satisfaction instrument which focused on the user as well as the functionality of the system, through the dimensions of content, format, accuracy, ease of use, and timeliness. Baroudi and Orlikowski (1988) assessed system satisfaction through the adoption of an information processing perspective examining the quality of the information product and the level of user knowledge and involvement. However, these instruments have been criticised for failing to incorporate the significant service component which modern information system functions are expected to deliver to their users, such as installation assistance, training, trouble-shooting, and maintenance (Pitt *et al.* 1995; Jiang *et al.* 2002).

In addressing this criticism, the internal service literature can be used to complement our understanding of user-perceived e-procurement quality. Of particular interest to this study are scales developed in a procurement context. Cavinato (1987) posits a set of five factors for measuring the service provision of a purchasing function: output of purchasing; interactions with purchasing; observations of purchasing; reputation of purchasing; and, expectations of purchasing. Rossler and Hirsz (1996) focus more specifically on outcome related performance measures in order to examine and understand user perceptions of procurement quality - service, accuracy, communication, responsiveness, professionalism, technical knowledge, and customer concerns. In contrast, Marshall *et al.* (1998) examine the processes by which quality is enhanced in a traditional procurement context. User-perceived quality is operationalised through the dimensions of: order processing; tender loving care; delivering value; vendor management; no surprises; problem solving and, conscientiousness.

Despite the attention paid to addressing user-perceived quality of procurement functions, there is a limited understanding of the construct in an *e-procurement* context. The exceptions are studies by Croom and Johnston (2003) and Brandon-Jones (2006,

2008). We build on these studies to examine user-perceived e-procurement quality in relation to six dimensions identified by Brandon-Jones (2006, 2008). In the next section we operationalise each dimension and develop hypotheses linking user-perceived e-procurement quality to contract and system compliance.

Hypotheses Development

Building on Brandon-Jones (2006 and 2008) we operationalise user-perceived e-procurement quality as a second-order construct consisting of six first-order dimensions*: professionalism, processing, training, specification, content,* and *usability*. Each dimension and its relation to user perceptions of e-procurement provision will now be outlined. *Professionalism*, the first dimension of user-perceived e-procurement quality, is concerned with the ongoing support provided to users, often by support personnel within the procurement function. When an individual encounters difficulties with an e-procurement system, it is important that support is available to help them. This dimension emphasises support availability, responsiveness, reliability, and the level of technical expertise to solve problems flexibly and effectively (Grönroos, 1984; Yang and Jun, 2002). In addition, *professionalism* is concerned with attitudes of support personnel and is measured through the degree of friendliness, concern shown, and the confidentiality of dealings (Silvestro and Johnston, 1992). The attitudes shown by support personnel are postulated to be an important component of the professionalism of the support function, which will directly influence the level of compliance (Pitt *et al.* 1995).

Training, the second dimension of user-perceived e-procurement quality, extends the focus of support provision, by examining how effectively information regarding the use of an e-procurement system is passed from service providers to users. Effective training should be tailored to an individual user's needs and can encompass the use of online tutorials, group sessions, advanced training on certain aspects of the system, refresher courses, or one-to-one help. The timeliness of training provision and extent to which training is updated in line with changes to the system are also highlighted (Kettinger *et al.*1995; Hallowell *et al.*1996). The effectiveness of the training provided is evaluated through the quality not only of the actual training, but the quality of the supporting manuals provided. Training provision is proposed to impact the willingness and capability of users to comply with the system.

Usability refers to the perceived ease of use and navigation around an e-procurement system. Firstly, a system should be available at all times as any downtime may cause frustration to users. If a system is unavailable for use due to an unreliable server for instance, users are likely to find alternative ways to place orders outside the system. In addition, the speed of connection will have a significant impact on perceptions of *usability*. If the server used by an organisation is slow, users will perceive the system as difficult to use. A system perceived as slow, especially in peak periods of usage, is likely to engender feelings of frustration and may encourage order abandonment in favour of alternative purchase methods. Finally, the system navigation variable is concerned with how easy users find it to work their way through the system, whether it be for order creation, authorisation, receipting, payment, or reporting (Trocchia and Janda, 2003; Voss, 2003; Sweeney and Lapp, 2004).

The *content* dimension of user-perceived e-procurement quality relates to user perceptions of the information that is loaded onto the system and how easy it is to find (Voss, 2003; Sweeney and Lapp, 2004). It also relates to the speed at which new supplier contracts are made available through the system. Users must be able to access content easily through effective search tools, and if the available content is perceived to be applicable and up-to-date, users are likely to have positive views of the system. Users will expect to have both the suppliers and catalogues that they use loaded onto the system. If the catalogue content is perceived to be limited, it is likely to result in orders being placed outside of pre-approved contracts. Issues may arise if the central purchasing department refuse to load a supplier because a contract already exists.

The *processing* dimension relates to the perceived impact of the e-procurement system on performance. Prior to order delivery, variables measured include the speed of processing an order using the system, the ease of authorising these orders, and how quickly orders reach suppliers (Wolfinbarger and Gilly, 2003). Users will also have perceptions of the impact on lead-time; of how often orders are delivered on time; and whether the right goods or services are delivered (Yang *et al.* 2003). Previous studies indicate that the use of e-procurement can often result in an improvement in the time taken to process an order (Zsidisin and Ellram, 2001). This is relevant to regular users of a system, who place repeat orders and develop a competency in using the system efficiently and effectively. In terms of processing, order-to-supplier speed is an important component of perceived quality. One obvious benefit of e-procurement is that once approved, orders are sent instantaneously to suppliers, which is an

improvement to sending orders by post or fax (Rossler and Hirsz, 1996). Order accuracy can be ensured through efficient processing given the reduction in data re-entry across the purchasing process (Lancioni *et al.* 2000).

Although perceptions of order lead-time, order accuracy, and on-time delivery are dependent on the actions of individual suppliers, improvements in these areas are aided by the effective processing capability of an e-procurement system on the part of the user. As order complexity increases, the processing speed, accuracy and capability of the system will have a greater impact on the user's perception of its quality. One example is that of service orders where requisitions and invoices are rarely matched. The perceived capability of the system to process complex orders is likely to have an impact on the level of user adoption – the lower the perceived capability of the e-procurement system to process complex orders, the greater use of alternative purchasing methods.

Finally, *specification* considers perceptions of system functionality (Silvestro and Johnston, 1992; Croom and Johnston, 2003). The ability of an e-procurement system to integrate with the financial management system and reconcile invoices may be important to some users (Bailey and Pearson, 1983). In addition, how easy the system is to configure to individual or departmental requirements may have a significant effect on user-perceived e-procurement quality (Wolfinbarger and Gilly, 2003). Finally, a number of users will have expectations relating to management information, so the reporting capability of the system will be important (Doll and Torkzadeh, 1998).

In this study, we build on Brandon-Jones (2006, 2008) in operationalising six dimensions of user-perceived e-procurement quality. Each of these dimensions symbolise what the user perceives to be important aspects of e-procurement provision. It is worth noting that within the e-procurement literature, the relationship between perceptions of e-procurement and adoption is largely anecdotal. However, more broadly, there is empirical evidence to support the view that perceptions of technologies are positively related to user acceptance (Davis, 1989; Cowles and Crosby, 1990; Dabholkar *et al.* 1996; Szajna, 1996; Venkatesh *et al.* 2003). For example, Davis (1989) notes how perceived usefulness is correlated with self-reported usage of technology, whilst Szajna (1996) makes the connection between ease of use and actual usage. We draw on these previous literature streams, which have examined perceived quality of information technology provision, in developing our hypotheses that user-

perceived e-procurement quality will directly impact on whether a user adopts a mandated system or contract. Thus,

Hypothesis 1: The level of user-perceived e-procurement quality positively influences the level of e-procurement system compliance

Hypothesis 2: The level of user-perceived e-procurement quality positively influences the level of e-procurement contract compliance

Research design

In order to examine our hypotheses, we invited e-procurement users in four organisations using e-procurement to participate in a survey. For all four organisations, the e-procurement software was purchased from an external provider and customised for internal use. The software supported purchase ordering, authorisation, receipting, invoicing, payment, and reporting. The purchasing departments were responsible for training users across their organisations to use the software, as well as providing ongoing support. The unit of analysis was at the level of the individual user and their perception of e-procurement provision within their respective organisations.

The four organisations varied in terms of size, budget, number of suppliers, and the number of individuals with access to e-procurement (Table 1). Considering volume and variety characteristics (Slack *et al.* 2010), organisations were selected to cover a broad range of procurement activity ranging from the high value, bespoke services to low value, high volume commodities (Figure 1). The fact that the four organisations adopted the same software package affords a degree of comparability, in that differences in compliance cannot be explained simply in terms of the use of different software.

Insert Table I about here (General characteristics of study organisations)
Insert Figure 1 about here (Volume-Variety dimensions of procurement activity)

Questionnaire design

The survey consisted of 33 paired-statements relating to components of user-perceived e-procurement quality. Based on the gap perspective of perceived quality (Parasuraman *et al.* 1985), the first set of statements related to user expectations and the second to user perceptions. Both sets of statements used 1-7 Likert scales ranging from 'strongly disagree' to 'strongly agree'. Measures for the dependent variables, system and contract compliance, were also included. Finally, three control variables were included. Firm

size was controlled for using the number of employees. In order to control for individual respondent differences, we controlled for the IT skills level of each respondent using a self reported scale of competency. We also controlled for the level of experience that respondents had with the e-procurement system. The draft survey was piloted with a number of academics with expertise in procurement and service quality work. Additional feedback was given by 18 e-procurement users in two organisations not involved in the main study, resulting in some minor changes to question wording. The items used in the final survey are shown in Appendix 1.

Data collection

The population for this research was defined as all those with access to the e-procurement software and support provided by the purchasing departments across the four studied organisations – which totalled 295 individuals. Whilst normally a sample is a subset of a population, Easterby-Smith *et al.* (1997) argue that where the population is small (<500), it may be best to distribute questionnaires to the entire group under investigation. Therefore, a census (100% sample) was applied.

Given this relatively small initial sample, it was important to ensure a much higher response rate than is typical for survey research. Whilst personally administered questionnaires can lead to a higher response rate (Cox *et al.* 2005), this option was not possible due to the geographical spread of potential respondents. Therefore, as suggested by Flynn *et al.* (1990) and Dillman (2000), prior to sending surveys, all potential respondents were contacted by phone to encourage cooperation with the research. This helped in gaining commitment to the study and reassuring individuals of anonymity. This was the first survey of e-procurement users to have been implemented by the study organisations, so survey fatigue was not a major problem. Initially, hard copies of the cover letter, survey and a pre-paid return envelope were sent to potential respondents. A reminder e-mail was sent out both two weeks and three weeks after the initial postal mailing with a survey attachment. Finally, a second hard copy mailing was sent four weeks after the initial mailing with a modified cover letter reiterating the importance of the research. Consequently, 274 usable questionnaires were returned, representing an extremely high response rate of 92.9% (See table I).

To ensure that the sample of responses obtained was representative, non-response bias was examined through a comparison of early and late waves of returned surveys using two tailed *t*-statistics across all the variables included in the survey (Armstrong

and Overton, 1977). No statistically significant differences among the variables were identified ($p<.05$), suggesting that non-response is not a concern in this study.

Data Analysis

Preliminary data preparation

Prior to testing the hypotheses outlined in this study, we carried out a number of preliminary data cleaning procedures namely: examination of outliers; missing value analysis; and, assessment of bias. Outlier testing involved calculating respondent Mahalanobis distances and checking standardised scores for exceptional values. There was just one respondent with standardised residuals +/- three standard deviations from the predicted residual. Hair *et al.* (1998) argue that unless one can prove that the outlier is not representative of any observation in the population, it is not advisable to delete it from analysis. Therefore, all data were retained prior to analysis.

Missing Value Analysis indicates that there are no missing values for items relating to user-perceived e-procurement quality and a low level of missing data for system compliance, contract compliance, and categorical variables. *T*-tests indicate that, in the vast majority of cases, there is no significant difference between variables for groups with missing and non-missing Y values. In addition, an overall test of randomness indicates no significant differences between the two patterns (Little's MCAR Test: Chi-Square 116.900, DF 1537, Sig. 1.000), so the missing data can be classified as missing completely at random. In this study, excluding missing values is the best choice because the valid sample for statistical tests remains high (Sekaran, 2003).

Considering common method bias, Harman's one-factor test revealed the presence of 15 factors with eigenvalues greater than 1.0 rather than a single factor, and only 25.6% of the total 72.8% variance explained by the first factor. This indicates no general factor is present and suggests common method bias may not be a major concern for the data (Aulakh and Gencturk, 2000; Podsakoff *et al.* 2003).

Factor analysis

In examining the components of user-perceived e-procurement quality, Bartlett's Test of Sphericity ($p<.000$) disproved the null hypothesis that no significant correlations exist between the variables. This, coupled with the KMO statistic (0.926), indicated that the data were suitable for factor analysis (Comrey and Lee, 1992). Items were examined through exploratory factor analysis using principal axis factoring with

oblique rotation and six factors with eigenvalues greater than 1.0 were retained (Tabachnick and Fidell, 2001). Table II shows the final factor solution with all loadings above .35 shown. Table III reports the correlation coefficients between the dependent, independent, and control variables, coefficient alphas, and variance inflation factors.

Insert Table II about here (User-perceived e-procurement quality factor analysis)
Insert Table III about here (Correlation matrix and descriptive statistics)

Construct reliability and validity

In relation to ensuring reliability, given the fact that the research was not longitudinal (test-retest reliability) and there is no alternative construct measure (parallel forms reliability), assessment of reliability focuses on internal consistency of the scale (Flynn *et al.* 1990). The Cronbach alpha for the six dimensions of user-perceived e-procurement quality range from 0.80 to 0.95, exceeding the minimum of 0.70 (Nunally, 1978; DeVellis, 2003). In addition, item-to-total correlations are high, ranging from .539 to .869 (Nunally, 1978; Churchill, 1979).

Content validity cannot be determined statistically, but rather by experts with reference to experience and literature (Nunally, 1978; Sekaran, 2003). The items used to measure user-perceived e-procurement quality draw on information systems and internal service literature. In addition, the survey was pilot tested by academic experts and practitioners with experience of e-procurement provision. Construct validity can be split into two elements. Convergent validity is established when items load on a single factor and are closely correlated with other items in these factors (Bagozzi, 1981). Discriminate validity is established if items and factors are truly different from one another (Carman, 1990). In this study, the rules of convergence and discrimination appear to hold, with only 3 of the original 33 items cross-loading. In addition, the scale exhibits high alphas for its six dimensions and high item-to-total scores. Finally, the high correlation between factors provides additional evidence of construct validity (Parasuraman *et al.,* 1988).

Hypothesis testing

Ordinary least squares (OLS) regression was used to test the hypothesised relationships between user-perceived e-procurement quality and compliance. Tests of normality indicated that none of the assumptions of OLS regression were violated. Data from the

274 usable survey responses were firstly analysed to examine the extent to which dimensions of user-perceived e-procurement quality predict both system and contract compliance.

Variance inflation factors (VIF) were examined to test for multicollinearity as they are an indicator of the effect that independent variables have on the standard error of the regression coefficient (Hair *et al.* 1998). Large VIF values (in excess of ten) indicate a high degree of multicollinearity between variables - large enough to unduly influence estimates. There are no coefficients with VIFs greater than two and therefore it is reasonable to conclude that the data set is inherently clean of any multicollinearity issues.

Model 1, in Table IV, presents the results relating to Hypothesis 1 – that user-perceived e-procurement quality positively impacts the level of system compliance. Firstly, the control variables (organisational size, IT skills and experience) were regressed against the dependent variable (system compliance). Then the predictor variables (*professionalism*, *processing*, *training*, *specification*, *content*, and *usability*) were regressed against system compliance. Model 1 indicates that *professionalism* (β =.44, $p.$<.001) and *content* (β =.13 $p.$<.05) are significantly positively related to system compliance. Therefore, we find partial support for Hypothesis 1 that user-perceived e-procurement quality positively impacts on system compliance. Specifically, our analysis indicates that the *professionalism* and *content* dimensions of user-perceived e-procurement quality are significantly related to the level of system compliance.

Hypothesis 2 states that user-perceived e-procurement quality positively impacts the level of contract compliance. Model 2, in Table IV, presents the results relating to this hypothesis. As before, the control variables were firstly regressed against the dependent variable (contract compliance). Then the predictor variables (*professionalism*, *processing*, *training*, *specification*, *content*, and *usability*) were regressed against contract compliance. The results indicate that *processing* (β =.24, $p.$<.001), *specification* (β =.13, $p.$<.05) and *content* (β =.28, $p.$<.001) were positively and significantly related to contract compliance. As such, we find partial support for Hypothesis 2 that user-perceived e-procurement quality positively impacts on contract compliance. In addition, our analysis indicates that the *processing*, *specification*, and *content* dimensions of user-perceived e-procurement quality are significantly related to contract compliance.

Insert Table IV about here - Regression user-perceived EPQ to system compliance (1) and contract compliance (2)

It is worth noting that the sample size significantly influences the power of the regression model. Very small samples (<20) only detect very strong relationships with certainty, whilst very large samples (>1000) may be oversensitive to statistical tests. In this study, using the six dimensions of user-perceived e-procurement quality as independent variables and specifying a .01 significance level, the data set of 274 respondents was able to detect R^2 values of around 7% and greater. The relatively large sample and small set of factors gives a high degree of confidence in the statistical power of regression analysis.

In summary, the analysis of survey data provides support for our hypotheses that increased user-perceived e-procurement quality results in higher levels of system and contract compliance. The analysis also indentifies dimensions of user-perceived e-procurement quality that are particularly important in predicting system and contract compliance (refer to Figure 2 for significant relationships identified).

Insert Figure 2 about here (Framework of significant relationships)

Discussion

In this paper we were concerned with examining how user-perceived e-procurement quality impacts on the maverick tendencies of users in terms of system and contract compliance. Analysis provides strong support for the positive relationship between user-perceived e-procurement quality and both types of compliance. As such, our work provides support for the largely anecdotal evidence presented in previous e-procurement studies (Marshall *et al.* 1998; Croom and Johnston, 2003; Reunis *et al.* 2004) and reinforces the empirical evidence within information systems research that perceptions of technologies are positively related to user acceptance (Davis, 1989; Dabholkar *et al.* 1996; Venkatesh *et al.* 2003).

In operationalising user-perceived e-procurement quality through six dimensions, we find that system and contract compliance are influenced by different dimensions. In examining key drivers of system compliance, the professionalism of the procurement function in support provision and the actual content of the e-procurement system appear to be particularly influential. In representing the availability, responsiveness, reliability,

expertise and attitudes of the supporting procurement personnel, *professionalism* highlights the importance that information system providers should place on delivering service components to their users or internal customers (Pitt *et al.* 1995; Jiang *et al.* 2002). Our findings indicate that a perceived inability to solve problems effectively results in users going outside of the system to place their orders. The importance of responsive and effective problem resolution, discussed in both internal service (Caruana and Pitt, 1997; Croom and Johnston, 2003; Kang *et al.* 2002) and information system literature (Pitt *et al.* 1995; Jiang *et al.* 2000), may be particularly acute if a user perceives the original problem to be the fault of the service provider (Gremler *et al.* 1994).

Support availability, an aspect of service quality discussed widely in the literature (Zhu *et al.* 2002; Gounaris and Dimitriadis, 2003), presents a significant challenge for small organisations where there may only be one or two individuals supporting e-procurement users. In addition, our analysis indicates a positive relationship between the attitudes shown by support personnel and levels of system compliance. This supports the work of Silvestro and Johnston (1992) amongst others, in emphasising the importance of friendliness and empathy in service delivery.

The *content* of an e-procurement system relates to the information that is loaded onto the system and how easy it is to search and locate required suppliers. A number of studies note the importance of ease-of-search in influencing adoption behaviours (Liu and Arnett, 2000; Zeithaml *et al.* 2000, 2002; Wolfinbarger and Gilly, 2003; Lim and Dubinsky, 2004). With content identified as a significant predictor of system compliance, this finding emphasises the requirement to ensure that the right supplier contracts are available, up-to-date and can be easily found, in order to facilitate user adoption. This finding is mirrored by literature which examines the importance of database accuracy and content (DeLone and McLean, 1992), and the selection of products and services available in determining the extent to which users will adopt a mandated system (Yang and Jun, 2002; Trocchia and Janda 2003). In addition to its influence on system compliance, the *content* dimension of user-perceived e-procurement quality was found to impact the level of contract compliance. It stands to reason that if an e-procurement system is not accurately updated on a timely basis with required supplier contracts, individuals will find alternative means to order outside the mandated contracts, even if it does represent a form of maverick behaviour.

The *processing* dimension of user-perceived e-procurement quality is found to be an important predictor of contract compliance. The significance of this dimension emphasises the importance of developing a system that is perceived by users to be efficient in working through an order process and identifying mandated contracts. Given that performance deliverables such as lead time, order accuracy and on-time delivery are included within the *processing* dimension, it can be concluded that users may choose suppliers outside mandated contracts if they are perceived to perform better in these areas. The significance of the *processing* dimension also suggests that if users perceive the e-procurement system as unable to deal with complex areas of procurement, they are likely to become non-compliant (Hendrick and Ruch, 1988). This aspect of e-procurement quality is rarely discussed within the literature though some of the broader dimensions of functionality, system quality and system design do include assessments of how well systems are able to deal with complexity.

Another important predictor of contract compliance was *specification* which underlines the importance of compatibility between the e-procurement system and others within an organisation, such as financial management systems. A well specified system which can communicate with the finance system will aid the matching of invoices, receipts and requisitions, reducing the likelihood that users will be non-compliant (Silvestro and Johnston, 1992; Croom and Johnston, 2003). Inadequate system integration is noted by Bailey and Pearson (1983) as damaging to user satisfaction with information systems and cited by the *IDC* report (2003) as a key problem for less successful e-procurement projects.

At a broader level, our research raises some interesting questions concerning a commonly held distinction between internal and external service contexts – that of choice. External customers typically have a choice over who they do business with and are able to switch to alternative service providers if they are dissatisfied (Finn *et al.* 1996). By contrast, users of internal services, such as the provision of e-procurement, often have little choice over their provider (Albrecht and Bradford, 1990). As such, they may be 'loyal' or compliant even when they are dissatisfied (Auty and Long, 1999; Farner *et al.* 2001). In many internal service environments, the lack of free market forces to encourage service improvement may lead to a 'take it or leave it' mentality (Albrecht and Bradford, 1990).

However, our data analysis challenges the perspective that those without choice become, in the words of Nagel and Cilliers (1990), 'captive' to internal suppliers. If the

logic held, we should have seen consistent levels of system and contract compliance regardless of user perceptions of e-procurement quality, because use was mandatory. In realty, there was a positive association between user-perceived e-procurement quality and maverick behaviour. This counters the assumption that the monopolistic dynamics common within internal service contexts are sufficient to ensure compliance. Individuals are always likely to find ways round official procurement processes if they are dissatisfied with service provision.

Even when an individual is compliant, they may still find ways to vent their dissatisfaction. For example, from a social psychology perspective, those with negative perceptions are likely to influence the beliefs and behaviours of others (Gino and Pisano, 2008), who may in turn become non-compliant. Dissatisfied users may also become non-compliant with other less strictly mandated processes in the organisation. Added to this, there has been a steady erosion of internal suppliers' inalienable 'right' to provide service. Gremler *et al.* (1994) comment that internal service departments are increasingly accountable for the quality of output delivered to the next operation in the chain – their internal customers. Farner *et al.* (2001) argue that the rise of outsourcing gives some individuals the option of exiting unsatisfactory relationships with internal suppliers.

Managerial and practical implications

Controlling maverick behaviour remains a key challenge for many organisations. In this paper, we have examined the relationship between two forms of maverick behaviour – non-compliance to mandated systems and contracts – and user perceptions of e-procurement quality. We can subsequently make recommendations to managers and practitioners based on our findings. This study emphasises the view that internal user satisfaction should be a key concern for organisations (Croom and Brandon-Jones, 2005). Our analysis indicates that user-perceived e-procurement quality plays a significant role in influencing the maverick behaviour. It is clear that, even when mandated, it may be difficult to force individuals to comply with systems and contracts that they are unhappy with. Therefore, managers trying to increase compliance are advised to measure user perceptions of e-procurement provision, during implementation and ongoing delivery, and focus on improving areas of dissatisfaction.

In seeking to manage maverick behaviour managers should be aware that the two types of compliance are influenced by different dimensions of user-perceived e-

procurement quality. From our findings we suggest that system compliance can be managed by focusing on *professionalism* and *content*. This highlights the importance of investment beyond the initial design of an e-procurement system. Resources should also be assigned to populating a system with appropriate suppliers for the user base and in providing professional support to enable individuals to use e-procurement systems more effectively. In relation to contract compliance, our analysis highlights the importance of *content, specification,* and *processing.* Given the importance of *specification*, assessment prior to implementation of how effectively an e-procurement system can integrate with other legacy systems should be considered by managers. Compliance with mandated contracts is also impacted by the processing capability of the system and how it interfaces with suppliers. As such, developing better relations with contracted suppliers may help deliver improvements on the performance metrics of order lead-time, order accuracy, and on-time delivery (Brandon-Jones *et al.* 2010).

An important point for e-procurement and other internal service providers to consider is that users are often unwilling to voice their discontent for fear of receiving even worse service in the future (Auty and Long, 1999). This is attributable to the fact that, unlike external customers, it can be more difficult for internal users to exit unsatisfactory relationships. In a similar way, social and psychological intra-organisational conditions limit the ability to freely complain (Paraskevas, 2001). Therefore, managers need to find opportunities for users to provide continuous and anonymous feedback which may help address their reluctance to voice dissatisfaction.

Conclusions

The advent of e-procurement has created significant potential to reduce the total cost of purchasing goods and services. However, such potential will only be realised if individuals comply with e-procurement systems and contracts. Building on previous research, we argue that how the user perceives the quality of e-procurement provision is important in influencing the level of maverick behaviour. Based on survey data from 274 e-procurement users, we find strong evidence of a positive relationship between user-perceived e-procurement quality and both system and contract compliance. This suggests that achieving the full potential benefits of e-procurement ultimately depends on delivering a system and support provision in a way that meets users' expectations. Our findings are very much in line with a behavioural operations perspective, which would suggest that the success of a system change, such as e-procurement provision, is

largely determined by those individuals expected to adopt new processes. Importantly, the user-perceived e-procurement quality scale is a diagnostic tool, rather than a solution in its own right. Whilst carrying out a survey will highlight areas of concern, further discussion with users is critical in understanding the specific nature of problems.

Our data suggest that different dimensions of user-perceived e-procurement quality may be important in predicting the two types of compliance examined in the study. The *professionalism* and *content* dimensions appear to be critical in influencing the level of system compliance, whilst the *processing*, *specification*, and *content* dimensions may be particularly influential on the level of contract compliance. Whilst these findings are interesting, they should not as yet be considered conclusive. Further replication studies are needed before making judgements regarding the relative importance of different dimensions of user-perceived e-procurement quality in influencing maverick behaviour.

Finally, our findings run contrary to the view that implementing e-procurement automatically leads to an increase in the levels of compliance. Despite the fact that system and contract use were mandated for the organisations in this study, compliance varied significantly depending on the level of user-perceived e-procurement quality. This counters the assumption that the monopolistic dynamics of e-procurement provision and many other internal services are, in themselves, sufficient to ensure compliance. Individuals are always likely to find ways round official processes that they dislike and forcing compliance may prove extremely difficult. Instead, reductions in maverick behaviour tend to occur when individuals are treated as internal customers and provided systems and support that meet or exceed their expectations.

Limitations and future research

As noted, organisations in this study covered a broad range of procurement activity ranging from the high value, bespoke services to low value, high volume commodities (See figure 1). However, empirical verification is clearly an ongoing process and replication studies would create increased confidence in the external validity of our research findings. Specifically, research which examines the relationship between user-perceived e-procurement quality and compliance in different cultural and behavioural environments would enrich our understanding of the drivers of system and contract compliance. From a social psychology perspective, the study presents some interesting opportunities for further work examining the impact individuals have on others within an organisation depending on their perceptions of e-procurement provision (Gino and

Pisano, 2008). Finally, from a socio-technical view of technology management, future studies could explore the social changes that may occur during the implementation of e-procurement and the way corporate politics may influence user perceptions (Howard *et al.* 2007).

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Figure1. Volume-Variety dimensions of procurement activity across study organistions

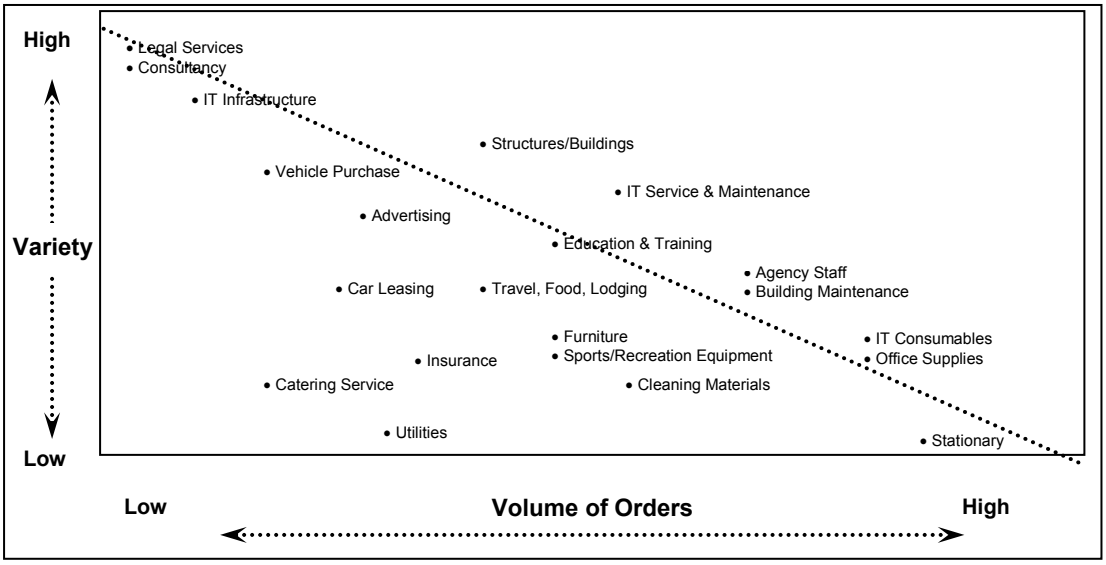

Figure 2. Framework of Significant Relationships

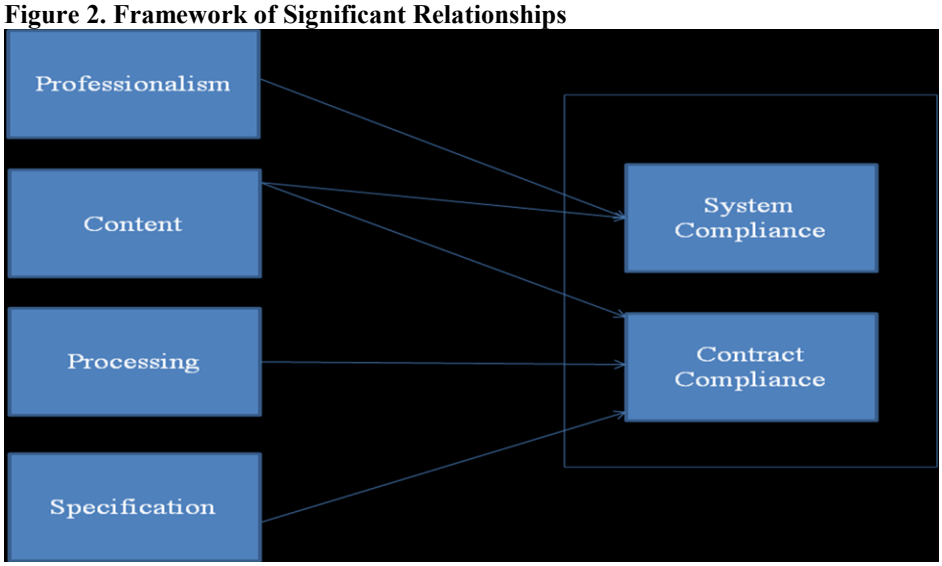

Table I. General characteristics of study organisations

	Org 1	Org 2	Org 3	Org 4
Number of employees (FTE)	800	200	450	26,500
Yearly budget (total)	£45 million	£18 million	£40 million	£1.6 billion
Yearly budget (goods and services)	£16 million	£6 million	£15 million	£600 million
Requisitions per annum	4000	2000	2900	150,000
Active suppliers	2500	800	2300	13,000
Previous procurement approach	Mix	Paper	Paper	Mix
E-procurement start date	Dec 03	Aug 03	Oct 03	Jan 03
Project team	Procurement	Finance	Procurement	Procurement
Roll-out strategy	Department	Department	Commodity	Commodity
E-procurement service users	44	41	54	156
Departments using e-procurement	8 of 9	4 of 4	11 of 11	13 of 15
Level of financial systems integration	Limited	None	Limited	Extensive
Use of reporting functionality	High	Low	Medium	High
Survey respondents	41 (93.2%)	37 (90.2%)	53 (98.1%)	143 (91.7%)

Table II. User-perceived e-procurement quality factor analysis

		Items					
1. Professionalism	**Item-to-total**	1	2	3	4	5	6
support availability	.807	.830					
support reliability	.818	.784					
support responsiveness	.869	.899					
support knowledge	.840	.822					
support flexibility	.791	.710					
Problem resolution	.824	.757					
confidentiality	.817	.829					
friendliness	.763	.867					
Attitudes	.793	.919					
2. Processing							
order processing speed	.721		.664				
ease of authorisation	.644		.547				
orders to supplier speed	.744		.901				
order lead-time	.756		.807				
processing complex orders	.608		.490				
on-time delivery	.724		.805				
order accuracy	.636		.693				
system security	.574		.567				
3. Training							
timely training	.859			.888			
appropriate training	.903			.982			
information provision	.755			.654			

4. Specification							
FMS integration	.599				.666		
invoice reconciliation	.692				.644		
system configurability	.592				.486		
reporting capability	.674				.719		
5. Content							
loaded suppliers	.666					.738	
loaded catalogues	.689					.870	
ease of search	.571					.473	
6. Usability							
system availability	.539						.409
screen loading speed	.639						.734
system navigation	.565						.625
Eigenvalues	-	13.440	3.840	1.584	1.503	1.323	1.119
Total Variance Explained	**78.32%**						

Table III. Correlation matrix and descriptive statistics

Variable	VIF	1	2	3	4	5	6	7	8	9	10	11
1. Contract Compliance	-	-										
2. System Compliance	-	.59**	-									
3. Professionalism	2.05	.46**	.51**	**.95**								
4. Processing	2.18	.57**	.39**	.48**	**.90**							
5. Training	1.89	.38**	.32**	.62**	.38**	**.92**						
6. Specification	1.93	.50**	.40**	.46**	.65**	.33**	**.82**					
7. Content	1.62	.56**	.37**	.35**	.51**	.27**	.48**	**.80**				
8. Usability	1.92	.48**	.36**	.44**	.60**	.40**	.59**	.48**	**.75**			
9. Size	1.03	.10	.04	.03	-.01	-.03	.05	.05	.04	-		
10. IT Skills	1.06	-.05	-.03	.11	-.01	.16**	-.03	-.03	-.04	.05	-	
11. Experience	1.04	.00	.07	.04	-.10	.03	-.11	-.05	-.04	.10	-.04	-

Cronbach alpha shown in bold on diagonal
** Correlation is significant at the 0.01 level (2-tailed).

Table IV. Regression user-perceived EPQ to system compliance (1) and contract compliance (2)

	Model 1 – System Compliance		***Model 2 – Contract Compliance***	
	β	β	β	β
Controls				
Organisation Size	.04	.02	.13	.06
IT Skills of User	-.03	-.04	-.04	-.01
Experience	.06	.06	-.02	.00
Direct effects				
Professionalism		.44***		.11
Processing		.10		.24***
Training		-.08		.06
Specification		.06		.13*
Content		.13*		.28***
Usability		.06		.07
ΔR^2	.01	.35***	.02	.45***
Overall R^2	.01	.36	.02	.47
Adjusted R^2	.00	.33	.00	.44
Overall Model *F*	.59	13.51***	1.19	18.02***

*p<05, **p<.01, ***p<.001

Appendix 1. Table of Measures

Variable	Survey item (1 = strongly disagree / 7= strongly agree)
Professionalism	
support availability	The purchasing department is always available to deal with my queries or problems.
support reliability	The purchasing department always gets back to me when they say they will.
support responsiveness	The purchasing department responds quickly to my queries or problems.
support flexibility	The purchasing department is flexible when dealing with unusual requests or problems.
support knowledge	The purchasing department is knowledgeable in dealing with my queries or problems.
problem resolution	The purchasing department deals effectively with any problems.
confidentiality	The purchasing department deals confidentially with my queries or problems.
attitudes	The purchasing department shows concern when dealing with my queries or problems.
friendliness	The purchasing department is friendly when dealing with queries or problems.
Processing	
order accuracy	The e-procurement system ensures that the right goods or services are delivered.
on-time delivery	The e-procurement system ensures that orders arrive on time.
ease of authorisation	The e-procurement system has an efficient authorisation process.
processing complex orders	The e-procurement system is capable of processing complex orders.
order lead-time	The e-procurement system reduces the lead-time of orders.
order processing speed	The e-procurement system ensures orders are processed quickly.
system security	The e-procurement system is secure.
orders to supplier speed	The e-procurement system ensures orders get to suppliers quickly.
Training	
information provision	The purchasing department provides useful information about the system.
timely training	The purchasing department provided me with timely training to use the system.
appropriate training	The purchasing department provided me with appropriate training to use the system.
Specification	
invoice reconciliation	The e-procurement system ensures easy reconciliation of invoices with requisitions.
FMS integration	The e-procurement system works effectively alongside the financial management system.
system configurability	The e-procurement system allows configuration by a department.
reporting capability	The e-procurement system allows appropriate reports to be run.
Content	
loaded supplier	The e-procurement system has the right number of suppliers loaded.
loaded catalogues	The e-procurement system has the right number of catalogues loaded.
ease of search	The e-procurement system allows easy searching for suppliers or items.
Usability	
screen loading speed	The e-procurement system moves quickly from one screen to the next.
system navigation	The e-procurement system allows easy navigation through the process.
system availability	The e-procurement system is available at all times.
Contract Compliance	% orders placed through a contracted supplier
System Compliance	% orders placed using the e-procurement system

About the authors

Dr Alistair Brandon-Jones is a Lecturer in Operations and Supply Management at the University of Bath and a visiting lecturer at Warwick Medical School. His main research interest is in customer-centric service design. This work focuses on the important role which internal and external customers can have in improving service delivery. In collaboration with a number of European and US universities, his second area of work builds on the International Purchasing Survey (www.ipsurvey.org). This work explores procurement processes and performance across the globe. Alistair is published in the International Journal of Operations and Production Management, Journal of Purchasing and Supply Management, and Journal of Public Procurement, and has co-authored a book with Professor Nigel Slack, Quantitative Analysis in Operations Management, published by Pearson.

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